Morphology and Thickness of Ion-Deposited Fluorocarbon Films by X-Ray Reflectivity

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Abstract No. Akin5360
Beamline(s): **X19C**

Luke Hanley and coworkers previously developed a mass-selected ion beam method to deposit nm thick fluorocarbon films on polymer and semiconductor surfaces. In April and August, we ran x-ray surface scattering on NSLS beamline X19C to examine the thickness and morphology of some of these thin fluorocarbon films. Our goal is develop an improved understanding of this new nanofabrication method by correlating the chemical and morphological structure of these films to the chemical structure, kinetic energy, and fluence of the incident ions.

X-ray reflectivity data is shown below for unmodified polystyrene (PS, bottom) and PS modified by 50 and 100 eV $C_3F_5^+$ ions. Preliminary analysis of this data indicates that 50 eV ions grow a fluorocarbon film that is 5 Å thick while 100 eV ions grow a thicker film. The unmodified and 50 eV ion-modified PS display an air-film interfacial roughness of 6 Å, while the 100 eV film is much rougher. We are currently working to refine these analyses, correlate them with atomic force microscopy, and use x-ray reflectivity to characterize this nanofabrication method for other ions, ion energies, and substrates.

References: M.B.J. Wijesundara *et al*., Proc. Nat. Acad. Sci. USA 97 (2000) 23.

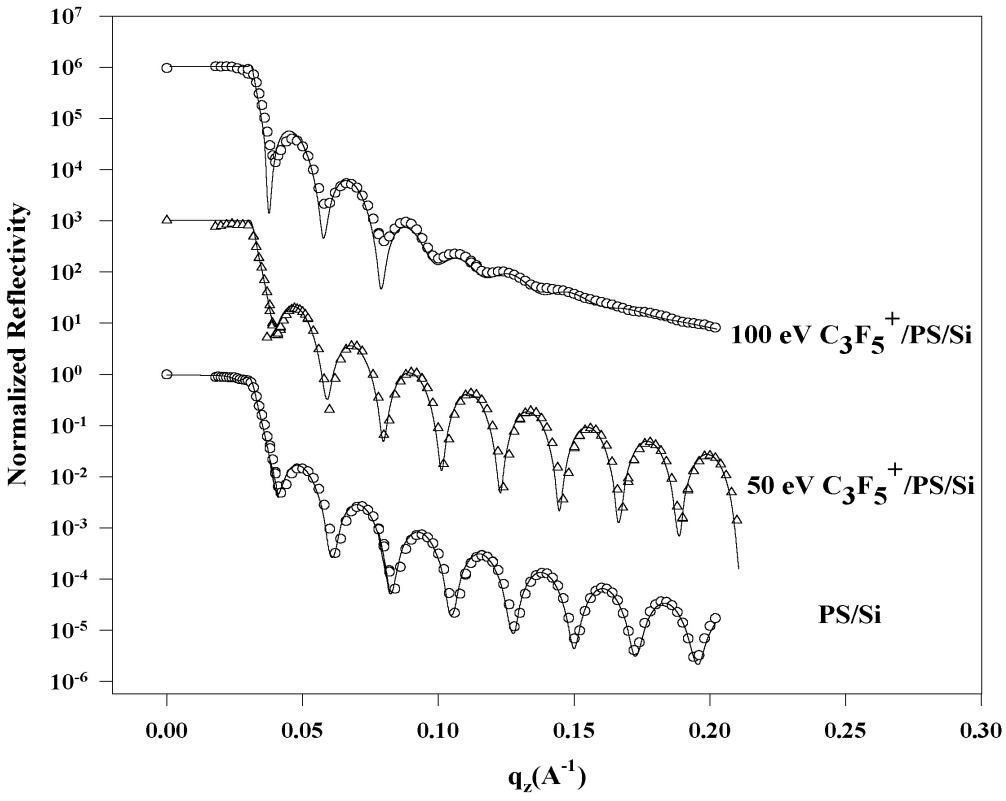

Figure 1. X-ray reflectivity data for unmodified polystyrene (PS, bottom) and PS modified by 50 eV (middle) and 100 eV $C_3F_5^+$ ions (top).